EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL ON ENVIRONMENTAL QUALITY
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WASHINGTON, D. C. 20006

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September 7, 1973

MEMORANDUM TO

All US Project Chairmen, US-USSR Environmental Program
CEQ: Chairman Train
Mr. Busterud
Dr. Willard
Dr. Talbot
Mr. Hayne
Mr Plehn
State: EUR/SES - Mr. Pardon (?)
EUR/SOV - Mr. Wilkinson
SCI/EN - Mr. Kulick
SCI/SA - Mr. Ganley
EPA - Mr. Strother
Amembassy Moscow - Dr. Tech (2 - one copy for Hydromet)
Soviet Embassy Washington - Dr. Belov
Interior - Dr. Skoog
DOD - Mr. Milias
NAS - Dr. Kellerman

I believe you will find the attached report of interest concerning the Climate working group.

Jack Perry
Special Assistant
to the Chairman

OBGI - (Both)
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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Rockville, Md. 20852

August 31, 1973

MEMORANDUM

To: Attendees of the Informal Preparatory Meeting of Working Group VIII on the Influence of Environmental Changes on Climate

From: Nels E. Johnson
Acting Director, International Affairs

Attached for your information are two copies of the Report of Informal Preparatory Meeting of Working Group VIII on the Influence of Environmental Changes on Climate, held in Washington, D.C., on August 27-29, 1973.

Attachment

Attendees: Dr. Wilmot N. Hess
Dr. Lester Machta
Mr. Donald H. Pack
Dr. Joseph Smagorinsky
Mr. J. O. Fletcher
Dr. A. J. Brobecker
Mr. S.C. Coroniti
Mr. M.J. Rubin
Mr. H. April
Mr. S.R. Olenicoff

cc: Mr. Jack Perry, CEQ

Report of Informal Preparatory Meeting of Working Group VIII
on the
Influence of Environmental Changes on Climate
in Washington, D.C., August 27-29, 1973

Taking advantage of the visit of Prefessor Y.P. Borisenkov and Dr. B.I. Sazonov in the United States, Dr. Izrael arranged with Dr. Hess for an informal meeting of Working Group VIII to consider specific proposals to be forwarded to the full committee on Cooperation in the Field of Environmental Protection.

The participants were:

U.S.S.R.

Prof. Yevgeniy P. Borisenkov (U.S.S.R. Chairman)
Director, Main Geophysical Observatory
Leningrad

Dr. Boris I. Sazonov
Main Geophysical Observatory
Leningrad

United States

Dr. Wilmot N. Hess (U.S. Chairman)
Director, Environmental Research Laboratories
NOAA

Dr. Lester Machta (U.S. Chairman, Subgroup 1)
Director, Air Resources Laboratory
NOAA

Mr. Donald H. Pack (U.S. Chairman, Subgroup 2)
Deputy Director, Air Resources Laboratory
NOAA

Dr. Joseph Smagorinsky (U.S. Chairman, Subgroup 3)
Director, Geophysical Fluid Dynamics Laboratory
NOAA

Mr. Joseph O. Fletcher (U.S. Chairman, Subgroup 4)
Director, Office of Polar Programs
National Science Foundation

Dr. Alan J. Grobecker (U.S. Chairman, Subgroup 5)
Director, CIAP Program
Department of Transportation

Mr. Samuel C. Coroniti, DOT
Mr. N. E. Johnson, NOAA
Mr. M.J. Rubin, NOAA
Mr. H. April, NOAA
Mr. S.R. Olenicoff, NSF

I. General Ideas About the Program of Working Group VIII

The following are identified as subject matter elements under Working Group VIII:

VIII 1. Effect of Changing Levels of Atmospheric Constituents on Climate.

VIII 2. Monitoring Atmospheric Constituents that Might Modify Climate.

VIII 3. Climate Modeling.

VIII 4. Cooperation in Polar Research.

VIII 5. Effects of Contamination of the Upper Atmosphere on Climate.

Two additional subjects were considered to be of sufficient significance as to warrant special attention by separate Subgroups. It is proposed that the following Subgroups be constituted:

VIII 6. Documentation on Climate Variability

VIII 7. Solar Influences on Climate Variations

Attachments 1-7 hereto are statements of proposed activities under these subject matter headings.

These Subgroups are expected to carry out their own programs of work on their special study areas relatively independently, and periodic meetings of the entire Working Group will be held to coordinate the work of the subgroups and to continue the general program of Working Group VIII.

It is proposed that exchanges of scientists be encouraged and arranged between Subgroup chairmen in order to carry out the work of Working Group VIII. Exchanges of individual scientists between institutions in the United States and the U.S.S.R. working on programs of the Subgroups are suggested for periods of 3-12 months.

Exchange visits of Working Group VIII members to institutions, observatories, field sites, and computer centers appropriate to their special study areas are encouraged.

When appropriate, subgroups should be encouraged to organize symposia for broad yet detailed exchange of current research results.

It is further recommended that an integral part of any cooperative activity planned under the several subject matter elements include the exchange of data and scientific results and intercalibration of instruments and methods of observation, as appropriate.

II. Proposed Programs of each Subgroup

The major areas of study are set forth in the attachments hereto. It is expected that they will be the basis for discussion at the forthcoming meeting of Working Group VIII in Leningrad in May 1974.

The U.S. delegation to the Leningrad meeting will be made up of approximately 10-12 scientists covering all subjects of Working Group VIII. There may be somewhat more Soviet scientists meeting with the U.S. delegation in Leningrad to cover in depth all the subject areas. The names of the Soviet chairmen of the subgroups will be provided to the U.S. delegation shortly. Correspondence between U.S. and U.S.S.R. chairmen of the subgroups is encouraged to help organize the work of the Leningrad meeting. The U.S. and U.S.S.R. chairmen of Working Group VIII will exchange names of the delegates of their countries who will attend the Leningrad meeting beforehand.

It is proposed that the U.S. and U.S.S.R. delegations exchange written reports before the Leningrad meeting on the work of each subgroup. These reports could be made up of published technical papers and reports of projects or new material specifically written for this meeting. The purpose of these reports would be to make each subgroup chairman roughly aware of the work being carried out on his problem area by the other country.

The activities of Subgroup VIII-4 have been progressing at a steady pace for some time. This is due to consultations based on already existing programs such as AIDJEX and other international planning for POLEX under the aegis of GARP. It is recommended that these activities be continued and amplified under Working Group VIII, but that discussions related to them not be limited to Working Group VIII.

III. Tentative Agenda for the Leningrad Meeting

It is proposed that the agenda be based on the subject matter of the several subgroups. Because of the wide range of topics, the detail that has to be covered, and the need to establish a firm basis for future steps in implementing the cooperation in these fields, it is recommended that the meeting consist of a plenary session on the first two days and the last day, with two intervening days of meetings of each of the subgroups including the preparation of reports to the final plenary.

An important adjunct to the meeting should be visits by each U.S. subgroup to appropriate U.S.S.R. laboratories and institutions doing significant work in the fields of the subject matter appropriate to Working Group VIII. This should require up to 5 days, including travel time.

IV. Comments

Full and open discussion by all participants expedited the work of the group. The chairman expressed appreciation for the support of the participants and the hospitality of NOAA which provided the locale and secretarial services.

Both the U.S. and U.S.S.R. delegations are very pleased with the prospects for future cooperation and are looking forward to the Leningrad Meeting of Working Group VIII in May 1974.

Signed in Washington, D.C., on August 29, 1973.

Prof. Y. P. Borisenkov
Director, Main Geophysical
Observatory
Leningrad

Dr. W. N. Hess
Director, Environmental
Research Laboratories
NOAA

Attachment 1

Proposed Program of Subgroup VIII-1 on the Effect of Changing Levels of Atmospheric Constituents on Climate

Climate may be influenced by changing levels of several atmospheric constituents. However, as a matter of first priority, the major areas of study of this Subgroup will initially be an investigation of optical properties of atmospheric dust particles.

1. Most scientists believe that increasing carbon dioxide and dust in the atmosphere are the leading candidates by which man's activities may have or will modify the climate on a global scale. In order to judge the climatic consequences of increasing dust particles, it is necessary to know the optical properties of the particles. By this is meant their effectiveness as scattering and absorption agents. Unfortunately, the measurement of these optical properties is very difficult and there are, consequently, very few observations. In addition to their optical properties, the numbers, sizes, and possibly shapes of particles in the 0.1 to about 5 micron range should be measured. There is now uncertainty about the climatic effects of atmospheric dust. Depending on the optical properties of the dust particles and other environmental factors, they may either heat or cool the lower atmosphere.

2. Topics at the Plenary Meeting will include the needs for and the present capability to measure atmospheric dust particles (both natural such as from volcanic eruptions and man made) and their optical properties.

   Topics for discussion at the Subgroup Meeting in Leningrad will include an evaluation of the following potential methods for obtaining the optical properties of atmospheric dust particles:

   a. Measurements of the direct and scattered solar beam and sky polarization.

   b. In-situ measurements by a nephelometer or similar instrument to determine the scattering or absorptive properties of the atmospheric aerosol.

   c. Collection of atmospheric particles on filter papers or other collectors followed by a laboratory analysis of their properties.

   d. Theoretical calculations of the optical properties of particles based on known composition, shape and size.

3. Possible areas for future cooperation include:

a. Measurement and analysis programs employing the most promising research avenues to determine the optical properties of the atmospheric dust particles.

b. If these promising avenues involve measurements of the atmospheric dust and they prove successful they may later be incorporated in the monitoring programs of the United States and the U.S.S.R.

c. Investigation of the atmospheric properties of other constituents with climate modification potential such as carbon dioxide and ozone, etc., should be undertaken.

Proposed Program of Subgroup VIII-2 on Monitoring Atmospheric Constituents that Might Modify Climate

A. The major area of study of this Subgroup will be the:

Measurements of trace materials in "clean air" and suggestions on the organization of a global network of stations to determine global background levels. their geographical variability and long-term trends. Achieving these objectives requires meticulous observation and rigid quality control. In addition, to maximize the usefulness of the individual national programs to produce a compatible global data base, a program to compare measurement programs, instruments and data processing is required.

Measurement needs have been outlined at the U.N. Conference on the Human Environment and the meteorological-climate need developed in greater detail by the WMO's program for regional and baseline monitoring. The WMO criteria for baseline stations--measurement of (1) turbidity, (2) carbon dioxide, and (3) collection of precipitation for chemical analyses--are priority items for consideration.

B. Topics for discussion at the Plenary Meeting in Leningrad will include general information on the U.S. Global Monitoring Stations and related U.S.S.R. work on techniques for measuring trace constituents of the atmosphere and the results of such measurements for CO_2 and O_3 and turbidity.

Topics for discussion at the Subgroup Meeting in Leningrad will include:

1. Requirements for siting Global Monitoring Stations.
2. Techniques for measuring CO_2 to 0.1 ppm
3. Preparation and use of reference gases
4. Precision measurements of Ozone.
5. Techniques for measuring atmosphere turbidity
6. Intercalibration of instruments

C. Possible areas for future cooperation include:

1. Exchange of visits to baseline observatories beginning with a visit by U.S. scientists to a U.S.S.R. baseline observatory site with a reciprocal visit to the U.S. Mauna Loa Observatory in connection with a subsequent meeting of the Working Group VIII.

2. Exchange of baseline monitoring instrumentation.

   Exchange and operation, at baseline stations of

   a. Carbon dioxide measuring system and/or

   b. radiometric systems for turbidity.

   This exchange would include a visit by the responsible scientist to the respective baseline stations for a sufficient time to instruct in equipment operation and resolve problems in systems integration (voltage, frequency, data logging, etc.).

3. Develop procedures, formats, and time schedules for data exchange from the respective baseline observatories.

Proposed Program of Subgroup VIII-3 on Climatic Modeling

A. The major area of study of this subgroup will be on numerical models of the atmosphere and/or oceans capable of predicting (1) the dispersive properties of the geophysical fluid media, and (2) the secondary reactions, such as climatic variability or sensitivity or possible instabilities, to changes in atmospheric constituents or boundary conditions.

This subject of modeling overlaps the work of other subgroups. The chairmen of the different subgroups might consider holding joint subgroup meetings or use other techniques to exchange data with Subgroup VIII 3.

B. Topics for discussion at the Plenary Meeting in Leningrad will include present and proposed programs in the United States and U.S.S.R. on numerical models capable of studying climatic change.

Topics for discussion at the Subgroup Meeting in Leningrad will include:

1. Effects of CO_2 changes in 1-dimensional and 3-dimensional models
2. Effects of solar constant changes in 1-dimensional and 3-dimensional models
3. Analysis of stability properties of some existing atmospheric models
4. Climatic effects of ocean-atmosphere interactions
5. Dispersive properties of the GFDL Zodiac model

C. Possible areas for future cooperation include:

1. Intercomparison of simulation properties of existing U.S. and U.S.S.R. climate models
2. The construction of new numerical models of the interactive atmosphere-hydrosphere-cryosphere system.
3. The design of simulation experiments
4. The analysis and interpretation of simulation experiments
5. The specification of new observational requirements

Such activity will be directed toward investigating the climatic impact of changes of:

- o gaseous constituents, e.g., CO_2, O_3, H_2O
- o particulate constituents, e.g., dust and clouds
- o solar radiation
- o surface albedo
- o surface heating
- o surface heat capacity
- o surface evaporability
- o oceanic mobility

Proposed Program of Subgroup VIII-4 on Cooperation in Polar Research

A. The major area of study of this subgroup will be an investigation of the influence of the polar regions in both hemispheres on the formation of the weather and climate of our planet. These studies will include:

1. An investigation of the dynamics of the ice cover and the numerical modeling of these processes.

2. An investigation of the mechanisms of thermal and dynamic interaction between the atmosphere and ocean in polar regions over ice surfaces and over intensely turbulent ocean surfaces.

3. An investigation of the components of the heat balance of the atmosphere and underlying surface in polar regions.

4. An investigation of water, ice, and energy exchange between polar regions and temperate latitudes.

5. Cooperative efforts directed toward establishing observation programs necessary for the numerical modeling of the interaction of the atmosphere, ice, and water in polar regions.

6. Cooperative field investigations.

B. Topics for discussion at the Plenary Meeting in Leningrad will include cooperative efforts under the POLEX program for the north polar regions and preparatory steps for a POLEX-South program, and also cooperative efforts between the ongoing AIDJEX program in the United States and POLEX program in the Soviet Union.

Topics for discussion at the Subgroup Meeting in Leningrad will include:

1. A discussion of theoretical models of ice cover dynamics and the results of numerical experiments conducted at the University of Washington (Seattle) and in the U.S.S.R. at the Arctic and Antarctic Research Institute, the Hydrometeorological Institute, and the Institute of Oceanology.

2. A discussion of the results of investigations on the thermodynamic interaction between atmosphere and ocean in the Arctic.

3. A discussion of possible cooperative experiments utilizing Soviet and U.S. automatic pack-ice stations in the Arctic.

4. A discussion of plans and practical possibilities for cooperative investigations in the northern parts of the Atlantic and Pacific Oceans using scientific research ships and satellites to study water, ice, and energy exchange between the polar regions and temperate latitudes.

C. Possible areas for future cooperation, including specific proposals to be implemented upon mutual agreement.

1. Exchange of Specialists - A continuing exchange of polar specialists should be initiated as soon as feasible with the aim of improving mutual understanding of common interests and activities, enhancing progress on specific problems of mutual interest and identifying mutually desirable avenues for cooperation.

Some specific recommendations in this area are as follows:

a. Soviet specialists in ice dynamics and computer application should join the AIDJEX theoretical modeling group at the University of Washington (Seattle) for approximately 6 months beginning early in 1974. These guest specialists should be followed by Soviet specialists in boundary layer fluid dynamics.

b. A U.S. specialist in polar bibliographic and information-exchange services should participate in a working visit to the U.S.S.R. early in 1974, followed by other U.S. guest specialists in ice dynamics and numerical modeling.

2. Joint Participation in Field Experiments - In March/April 1974, a small AIDJEX Field experiment on thermodynamic ocean/atmosphere interaction will be conducted on the pack ice north of Barrow, Alaska. It would be desirable for a Soviet specialist in boundary layer theory to participate in this experiment. The principal U.S. investigator for this experiment is Dr. Clayton Paulson at Oregon State University (Corvallis, Oregon). The Soviet guest specialist should arrive by approximately February 1, 1974, to allow for project discussion and orientation before proceeding to the field site.

3. Coordination of Field Measurements - It is proposed that U.S. and U.S.S.R. field measurements of ice dynamics and ocean/atmosphere parameters be conducted in such ways as to provide maximum mutual support of common experimental objectives. Particular attention should be given to opportunities for mutual support in the employment of automatic stations on pack ice, and to the intercalibration of instruments and methods of observation.

Some specific possibilities in this area are as follows:

a. The automatic data buoy array planned for the main AIDJEX experiment in 1975-76 could be augmented by Soviet DARMS stations located according to a jointly prepared plan. The AIDJEX data buoys would at the same time serve to extend and augment the data and area coverage of the DARMS network. Thus, both the U.S. and U.S.S.R. national programs and the international POLEX and GARP programs would be enhanced.

b. The possibility of coupling the RAMS-NIMBUS F data relay and positioning system with the DARMS sensor systems should be evaluated and discussed and, if possible, implemented for mutually-beneficial use during the AIDJEX experiment.

c. The exchange of U.S. and Soviet specialists between drifting stations and scientific research ships, as well as possible joint logistic support for special cooperative efforts supporting the objectives of POLEX and AIDJEX should be discussed and evaluated.

4. Exchange of Ice Cores - One of the most useful means of reconstructing past variations in global climate is the analysis of ice cores obtained in polar regions. The vast opportunities for the application of this technique are limited by the relatively expensive drilling required for the extraction of cores from Arctic and Antarctic ice fields. Once obtained, only one-fourth to one-half of a core is adequate for most analysis purposes. It is recommended that, to the extent feasible, ice cores or core sections be exchanged to permit independent analysis and comparison of results.

Proposed Program of Subgroup VIII-5 on Effects of Contamination of the Upper Atmosphere on Climate

A. The major area of study of this subgroup will be on alterations of the upper atmosphere and stratosphere by high flying airplanes. In order to understand these alterations it is necessary also to understand the natural properties of the stratosphere. In the United States, the Department of Transportation has a Climatic Impact Assessment Program (CIAP) to study this problem.

B. Topics for discussion at the Plenary Meeting at Leningrad will include general information on the U.S. CIAP program and related U.S.S.R. work including measurements of effluents of aircraft, measurements of natural stratospheric composition, studies of photochemical processes and reaction rates, studies of models of the stratosphere, and discussions of possible changes of stratospheric properties related to high-flying aircraft.

Topics for discussion at the Subgroup Meeting at Leningrad will include:

1. What are the general interrelations of radiation and dynamic control of the stratosphere, photochemistry, climatology, and dynamics of the stratosphere?

2. What are the sources, sinks, and residence times of stratospheric constituents?

3. What are the important chemical reactions of the gases in the stratosphere?

4. How well known are the chemical rate coefficients and which of these need further study?

5. What naturally resident aerosols need to be introduced into our calculations?

6. What species are emitted, at what mass rate, at optimum power levels of the engines which will be flying at stratospheric altitudes?

7. What are the routes and frequency of travel which are projected for 1990?

8. How is the height distribution of radiation within the stratosphere determined?

9. How is the radiation affected by the gaseous and aerosol constituents of the atmosphere?

10. What is the radiation within the stratosphere received from the sun, expressed in terms of mean and standard deviations?

11. What is the radiation within the stratosphere received from below?

12. What are the sources of motion within the stratosphere?

13. What is the spectrum of motion energy within the stratosphere, expressed in terms of mean and standard deviations?

14. What is the interrelation of gradients of temperature, velocity, and chemical densities?

15. What are the mean temperatures and winds in the stratosphere and how do they vary as functions of latitude, longitude, and altitude?

16. What factors must be included in a computer simulation of the stratosphere?

17. What are the limitations on computer stratospheric simulations done in the next 2 years?

18. In what ways can a complete model of the stratosphere-troposphere-ocean, as planned for future development at Geophysical Fluid Dynamics Laboratory, be abridged to derive answers desired by CIAP?

19. What concepts and techniques for remote and in situ measurements are presently available and most applicable to measure water vapor, ozone, the trace gases important to CIAP, and particulates?

20. What direct observations of the climatology of the troposphere can be of assistance in exploring troposphere-stratosphere relations?

The Subgroup 5 meeting in Leningrad will work from this list of questions but they will not all be covered in detail.

C. Possible areas of future cooperation include:

1. Exchange of data on stratospheric composition

2. Exchange of data on aircraft effluents in the atmosphere and how they are measured.

3. Exchange of information on end results of stratospheric models.

4. Exchange of information on plans and studies on proposed effluents of high flying aircraft.

5. Development of a joint program of study on effects from high flying aircraft.

6. Experimental measurements of time and spatial variations of natural stratospheric gases and aerosols.

7. The monitoring of ultraviolet on the ground.

8. The development of reliable instruments to measure, in-situ, of stratospheric gases, especially water vapor and NO_x.

9. Study the interaction of aircraft effluents with the constituents of the natural stratosphere.

Attachment 6

Proposal for New Subgroup VIII-6 on Documentation of Climatic Variability

An essential element in understanding the sensitivity of climate to environmental changes is a knowledge and an understanding of climatic variations of the past. The purpose of this Subgroup is to assemble specialists in the disciplines now contributing to the developing field of climatography and to organize joint efforts to measure and to establish the character and geographic extent of past climatic variations.

The investigations essentially fall into several broad time spans:

1. The past several decades during which new global aerological observations have been available. Systematic cloud and humidity observations are relatively unique to this time span.

2. The past century during which industrialization may have been a factor.

3. The past several thousand years during which recorded history is available.

4. Paleoclimatic epochs, particularly the quarternary glaciation, which are only accessible through interpretation of natural remnants of the past.

The latter time span and to some extent the former ones, require meteorological interpretation of data provided by experts in geology, glaciology, dendrochronology, ice coring and ocean bottom sedimentation.

Detailed discussion of the need for and requirement for fulfilling this task is contained in the forthcoming report of the U.S. National Academy of Science Committee on Climatic Variation.

Attachment 7

Proposal for Adding an Additional Subject to the Program of Working Group VIII-7

The U.S. and U.S.S.R. members of the Preparatory Meeting of Working Group VIII propose that we add as a new subject for Working Group VIII a study of Solar Activity and Its Effect on Climate. There has been considerable interest in this subject in recent years both in the United States and in the U.S.S.R. A session of the IUGG Conference at Moscow in 1971 and a forthcoming conference at the Goddard Space Flight Center of NASA both study this subject. It seems proper now to try to start a cooperative effort between U.S. and U.S.S.R. scientists to increase our knowledge of this subject. We propose to add a Subgroup 7 on this subject and to have this Subgroup meet with the rest of Working Group VIII at Leningrad. If this proposal is approved, Subgroup 7 members would carry out the following activities at the Leningrad meeting:

1. Present selected scientific lectures on empirical findings and possible physical mechanisms involved in interactions between solar activity and meteorological phenomena.

2. Present and adopt formal plans for exchanges of data and information involving U.S. and U.S.S.R. work in progress under the Working Group VIII program, in the subcommittee area.

3. Hold discussions of special observations needed to advance the understanding of possible physical mechanisms to explain the empirical findings.

4. Present plans for the exchange of scientists under the subcommittee auspices.

Possible areas for future cooperative studies by this new Subgroup might be:

1. Make measurements and exchange data on solar magnetic field sector boundaries, in order to extend data base for vorticity and other circulation analyses.

2. Prepare north hemisphere contour maps of high positive vorticity before and after geomagnetic key dates (dates of large rise of geomagnetic index) for comparison with already existing pressure maps, extend such techniques to other circulation indices and new time periods.

3. Analyze 300 mb vorticity maps and other circulation patterns following the January to June 1973 large recurrent auroral disturbances. Place emphasis on vorticity behavior in Gulf of Alaska area and in the area east of the Urals, in Siberia. (Twenty-seven day recurrence as well as pronounced associations of geomatnetic-auroral disturbances may be expected with circulation indices in this period.)

4. Analyze cirrus cloud formation as related to geomagnetic disturbances over the Gulf of Alaska and Siberian areas east of the Urals. (Will require satellite data.)

5. Seek means for improving observations (satellite or ground) the measurement of large-area average thunderstorm activity before and after geomagnetic disturbances and other manifestations of solar activity.